Contact Information

These are the office hours I will normally try to keep. Stuff happens, though, so I advise you to check my availability through Blue Hen Success Collaborative (BHSC). Contact me by email, in-person, or on the phone. If you are in the College of Arts & Science (No access to BHSC) or if you need a time outside my regular office hours, contact me by email, phone, or in-person to schedule a meeting.

<table>
<thead>
<tr>
<th>Instructor: Carmine C. Balascio, Ph.D., P.E.</th>
<th>Office Phone: 302-831-8872</th>
<th>Email: <a href="mailto:carmine@udel.edu">carmine@udel.edu</a></th>
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<tr>
<td>Office: 157 TNS</td>
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<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Room</th>
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<tbody>
<tr>
<td>Monday</td>
<td>12:30-02:00</td>
<td>PRS 116</td>
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<tr>
<td>Tuesday/Thursday</td>
<td>03:00-04:30</td>
<td>TNS 157</td>
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<tr>
<td>Wednesday</td>
<td>10:30-12:00</td>
<td>TNS 157</td>
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Links

| UD Library | Code of Conduct | LON-CAPA Problem Set Site |

Learning Outcomes

Program Goals
EAC of ABET student outcomes: Elements of this course strengthen these EAC of ABET program outcomes:
(a) an ability to apply knowledge of mathematics, science, and engineering,
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
(d) an ability to function on multidisciplinary teams,
(e) an ability to identify, formulate, and solve engineering problems
(g) an ability to communicate effectively, and
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**UD General Education Goals:** These UD general education objectives are addressed:
- 1. Read critically, analyze arguments and information, and engage in constructive ideation.
- 3. Work collaboratively and independently within and across a variety of cultural contexts and a spectrum of differences.
- 5. Reason quantitatively, computationally, and scientifically.

## Course Logistics

### Objectives
The objective of this course is to apply knowledge of hydraulics and urban hydrology for design of the key conventional components of urban drainage systems: surface drainage, culverts, and storm drains. Industry standard proprietary and non-proprietary hydraulics and hydrology software in addition to spreadsheet programming and web resources will be used to facilitate the design work. Upon completion of this course, the student will be able to:

- Calculate normal and critical depths in open-channel flows for typical cross-sections.
- Design culverts using the methodology outlined in HDS-5 (Schall et al. 2012).
- Delineate watershed boundaries using contour maps.
- Use TR-55 methodology (U.S. Soil Conservation Service, Engineering Division 1986) to calculate runoff depths and peak flows for present and developed conditions.
- Design storm-drain systems using the Rational Method and gravity flow conditions.
- Design and analyze conventional curb and gutter street drainage, storm drain inlets, and storm drains using HEC-22 methodology (Brown et al. 2013).

### Course Description

Revised Catalog Description:

Hydraulics and hydrology for urban/suburban watersheds. Design of culverts, street drainage, storm drain inlets and storm drains. Prerequisite: CIEG 305 (Fluid Mechanics).

### Course Information

Course Number and Title: CIEG/LARC 431 Urban Hydrology & Drainage Design

Meeting Times and Location:
Lecture: Tu 9:05AM - 10:45AM, 046 Colburn Lab
Lab: Th 8:00AM – 10:45AM, 046 Colburn Lab

Prerequisites: CIEG305


Note: Any student who has a need for accommodation/s based upon the impact of a disability should contact me as soon as possible. Contact the Office of Disabilities Support Services to coordinate appropriate accommodations.
Assignments/Exams

Information about Exams and Quizzes:

• A brief content quiz will be administered through Canvas before the beginning of each lecture period. The intent is to give you an added incentive to review the reading assignments for that day's activities. The quiz must be completed before you come to class and will generally be available by the day after the previous quiz was due. The quizzes are individual assignments! You are expected to AVOID COLLABORATION with your fellow students on the quizzes!

• There will be two exams given during the semester and a cumulative final during finals week. Exams will be in two parts: the first part closed book, closed notes; the second part open book, open notes. When you’ve completed the closed book portion, turn it in to get the open-book part.

• On the days of the exams, you are responsible for having with you a calculator, pencil, eraser, and any resources you might need for the open-book portion of the exam: text, notes, reference materials, etc.

• For closed-book portions of exams, I don’t expect you to memorize extremely detailed procedures or complicated formulas, but you should have a good grasp of the overall concepts, sequence of steps, and underlying theory. Simple formulas that are used all the time (e.g. Manning’s equation, Froude number, etc.) you should know by heart.

• You will be taking the exam in a computer laboratory and will have a work station at your seat. NO ACCESS TO THE COMPUTERS OR THE WEB WILL BE ALLOWED DURING THE EXAM! I will ask you to turn off the computer screen at your seat before the exam begins, and it must remain off for the duration of the exam.

Deliverables (Assignments, Projects, etc.)

• Hand-graded assignments and projects will be collected for grading on due dates specified at the time they are assigned and must be submitted using the Assignments feature of Canvas. NOTE! Hand-graded work submitted late will be subject to a penalty of 10% per day up to a maximum of 50%.

• LON-CAPA problem sets: Computer-graded online problem sets on the LON-CAPA system are used in this course. Access the LON-CAPA problem sets through this URL: 
  
zappa.ags.udel.edu

See http://zaphod lite.msu.edu/student/getting_started.html for details about using the LON-CAPA system. Some important things to know about my policy for the problem sets:

− Computer-graded problems on the LON-CAPA system must be completed by the due date posted on the web site to receive credit. You know immediately upon submittal whether your answer is correct. You will be able to see the correct answers after the due date.

− You will be given 5 attempts to solve each problem. If you run out of attempts, see me about getting more. We'll try to find out what you're doing wrong before I give you more attempts.
- You will receive full credit for each problem you correctly solve before the due date, regardless of the number of attempts you make. You will receive zero credit for problems not completed by the due date.
- If you can document an erroneous computer solution to a LON-CAPA problem, turn in a written error report. Upon confirmation, you will be awarded five times the point value for that problem as a bonus.

- I use the online system, LON-CAPA, because of the following advantages:
  - Every student gets basically the same questions, but the numbers are different; so each student is forced to work out the solution for him or herself.
  - Mastery-based grading allows you to make multiple attempts to solve the problems. You get immediate feedback and remain engaged with the material until you understand it well enough to solve the problems.
  - You have a good shot at getting every question correct and collecting full credit for each problem. Since the LON-CAPA problem sets are worth the largest portion of the 27% of your grade comprised of individual assignments, there is considerable incentive to devote some effort to them.

- Here are my suggestions for getting the most out of the problem sets:
  - By all means, discuss the LON-CAPA problems with your classmates. Talk about the possible approaches to solving the problems. Do not simply plug your numbers into a class mate’s solution, however! You need to understand the solution procedure! If you’re having trouble, ask me to help you understand how to solve the problems.
  - Maintain a written record of the solutions to the LON-CAPA problems, just as you would for homework problems assigned from the text. If you like, print out the problem statements to avoid rewriting them. Keep all your solved problems collected in a three-ring binder. Use the collected solutions to review for exams.
  - Please, feel free to contact me for assistance. You can contact me in my office in person, over the phone, or by email. I encourage you to post questions on the Canvas Discussions site so other people who may have similar questions can benefit.
  - I recommend that if you find you are spending more than 20 minutes on any single problem either because you don't understand it or for some reason can't figure it out, STOP! Contact me for assistance. Don't waste your time unproductively spinning your wheels!

- In addition to the problem sets I assign, I will sometimes suggest problems from the text for you to work that will be of assistance when you study for exams. These problems will not typically be collected, but they or similar problems may appear on an exam.

Grading/Course Policies

Components of Your Grade:

- You will receive grades for the items in the table below, the components weighted as shown for your overall grade. There will be no opportunity for “extra credit”. Concentrate on making a steady effort throughout the semester.
### Course Policies

- **Attendance:** Class attendance is critical. Students who consistently miss class **will** do poorly in this course. You will be working in teams throughout the semester and must be present to support your team. **Each unexcused absence from a class or laboratory during which group activities take place will result in a five-percentage point reduction in your final grade.** Legitimate reasons for missing class must be properly documented (e.g. a note from your doctor).

- **Unexcused absence from an examination or quiz** results in a grade of zero (0) for that test. Legitimate reasons for missing a test must be well-documented. Oversleeping or “getting caught in traffic” are not acceptable. You must attempt to notify me as soon as possible.

- **Preparation for Class:** As much as possible I want this to be a learn-by-doing class which will have you spending the bulk of your class time solving problems and doing design work either as an individual or in groups. To spend less time on lecture, I expect you to be prepared for class by having the reading assignments done well beforehand. You’ll have the opportunity before and during class to ask questions about points for which you’d like further explanation. There will be brief quiz on content of the reading assignments due before the beginning of each lecture period to motivate you to do the assigned reading.

- **Academic Integrity:** Students are encouraged to help one another in learning the material and even to discuss specific assignments with one another. Copying or "teamwork" on assignments not done as a team or group is prohibited, however. Any work submitted that is the product of collaborative efforts **must** show the names of all collaborators. This means, for example: work the assignments and problem sets yourself, write every word of the individual assignments and reports yourself, properly cite the sources you used for information (even if they're class notes or handouts), write any spreadsheet programs yourself, etc. I would suggest you familiarize yourself with the university’s policy on academic honesty.

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You will be working in small groups or teams for several of the assignments and the design project in this course. Typically, you will submit one report or assignment for your entire team. It is important that you list the names of all team members on such submissions. No assignments are collaborative unless specifically indicated as such by the instructor. I would suggest you familiarize yourself with the university’s policy on academic honesty.
Teaching Methods

Instructional Approach
The knowledge you’ll gain in this course is very technical. It's difficult to understand it without actively working with the material and, perhaps, even struggling with it. The problem sets play an important part in your learning of the material. Please see comments under the Assignments section that provide more information about the problem sets. Laboratory times will typically be used for problem solving activities or design work. I will attempt to incorporate some form of active learning in every class. A major portion of the course will focus on the design project, which will require you to work in teams with "real world" data. Toward the end of the semester, there will be significant periods of class time devoted to group work on the design project.

Continuous Learning and Course Software
- I will offer some pointers, but the objectives of this course DO NOT include providing the student with detailed instructions for using the software that accompanies your text and that is installed on the computer stations. The primary responsibility for learning to use the software rests with you. Software changes all the time. When you find yourself in the workforce, you will, for the most part, be expected to learn how to use and keep up with changes to existing software packages and additions of new ones through your own initiative. It's a part of the continuous learning process in which a professional is expected to engage!
- You will learn the underlying theory and procedures for doing what the software does. You will be expected to do equivalent simplified hand calculations to demonstrate your knowledge. You should always verify software output for different exemplary kinds of problems by comparing to hand calculations and by using common sense and logic. After establishing familiarity with a software package and gaining an understanding of what it does and how it works, you can use a new software package correctly and with confidence.
- The software programs are provided as design tools you can use to facilitate the design process for the several team projects. You are welcome to use hand calculations and spreadsheet methods if you don’t want to learn how to use the software.
Supplemental References
The following is a list of supplemental references that are often cited in your course materials or are just good sources of information related the contents of this course. Some are available on the web and links are posted on the course Canvas site.

# Course Events

**Civil and Environmental Engineering, CIEG 431 Urban Hydrology & Drainage Design, Tentative Schedule, Spring 2019**

<table>
<thead>
<tr>
<th>Week #</th>
<th>Tues. Date</th>
<th>Tuesday Studio 8:15 to 10:45</th>
<th>Thursday Studio 8:15 to 10:45</th>
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<tbody>
<tr>
<td>1</td>
<td>Feb 12</td>
<td>Introduction to course, Review of Open-Channel Hydraulics, Cross-Section Geometry, Manning’s Equation, Conservation of Energy, Normal and Critical Depths</td>
<td>Channels of Most Efficient Hydraulic Cross-Section, Problem Set: Normal and Critical Depths in Open Channels</td>
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<tr>
<td>3</td>
<td>Feb 26</td>
<td>Water-Surface Profile Calculations, Problem Set: Water-Surface Profiles, Simplified Stilling Basin Design</td>
<td>Problem Set: Water-Surface Profiles, Simplified Stilling Basin Design</td>
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<tr>
<td>4</td>
<td>Mar 05</td>
<td>Introduction to Culvert Hydraulics and Design, HDS-5: Hydraulic Design of Highway Culverts</td>
<td>Problem Set: Culvert Hydraulics and Design</td>
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<td>6</td>
<td>Mar 19</td>
<td><strong>EXAM 1</strong> – covers material from beginning of course through rainfall, hydrologic abstractions, and runoff.</td>
<td>Unit Hydrograph Theory and Applications, TR-55, Ch 3: Time of Concentration &amp; Travel Time, Problem Set: Unit Hydrographs,</td>
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<td><strong>Spring Break</strong></td>
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<tr>
<td>8</td>
<td>Apr 09</td>
<td><strong>Project 1: Present &amp; Developed Condition Hydrology from Site Plans</strong></td>
<td>Group work on Project 1</td>
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<tr>
<td>9</td>
<td>Apr 16</td>
<td>The Rational Method and Gravity-Flow Storm-Drain Design</td>
<td>Storm-Drain Hydraulics: Hydraulic Grade Line Calculations, Problem Set: Gravity flow storm-drain design</td>
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<tr>
<td>10</td>
<td>Apr 23</td>
<td>Street Gutter Hydraulics &amp; Design, (HEC-22), Problem Set: Street Gutters</td>
<td>Storm-Drain Inlet Hydraulics &amp; Design: Inlets on Grade, Inlets in Sag (HEC-22), Problem Set: Storm Drain Inlets,</td>
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<tr>
<td>11</td>
<td>Apr 30</td>
<td><strong>Project 2: Storm-Drain Analysis &amp; Design</strong>, Review for Exam</td>
<td><strong>EXAM 2</strong> - Covers Material from TR-55, Ch. 2, through Storm-Drain Hydraulics: Hydraulic Grade Line Calculations</td>
</tr>
<tr>
<td>12</td>
<td>May 07</td>
<td>StormCAD Model for Gravity Flow Storm-Drain Design Problem, Work on Project 2</td>
<td>Group Work on Project 2, Review of Exam</td>
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<tr>
<td>13</td>
<td>May 14</td>
<td>Group Work on Project 2</td>
<td>Group Work on Project 2</td>
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<tr>
<td>14</td>
<td>May 21</td>
<td><strong>Final Exam</strong> – Exam is cumulative but will focus more on material beginning with Storm-Drain Hydraulics through end of course.</td>
<td><strong>Final Exam</strong> – Thursday May 23, 8:00 AM to 10:00 AM, 046 CLB</td>
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**Finals Week**